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Novel bifunctional nanofiller (bioactive\antimicrobial) for improving dental adhesives efficacy

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Developing multifunctional dental biomaterials is the target of recent dental research so this study aimed to develop novel bio composite nanofiller (Quaternary polyethyleneimine\Hydroxyapatite (QPEI/HAp)), which combine the antibacterial activity of polymeric quaternary ammonium salt and the multi-advantages of Hydroxyapatite nanoparticles for improving biological and physicomechanical properties of dental adhesives. Hydroxyapatite (HAp) nanorods were produced by hydrothermal process and coated by Polyethyleneimine (PEI) via electrostatic adsorption, followed by two steps polymeric reaction for quaternization. Powder characterization was done using XRD, FTIR and TEM before and after polymer coating and bioactivity was evaluated using XRD after seven days' soaking in simulated body fluid. An experimental ethanol-based one-bottle adhesive resin was formulated with 0.2, 0.5, 1, 2 and 5% QPEI/HAp nanofiller concentrations. The formulated adhesives were evaluated for their colloidal stability, antibacterial activity, ultimate tensile strength and micro-shear bond strength to dentin. Powder characterization confirmed successful surface modification of Hydroxyapatite nanoparticles with PEI polymer; the particles presented a high crystallinity with typical chemical groups and nanometer mean size around 20 nm. XRD analysis revealed nucleation of apatite crystals on the surface of QPEI/HAp nanoparticles after soaking in SBF; confirming their bioactivity. Lower contents of modified nanoparticles showed little or no aggregation tendency and good colloidal stability in the adhesive solution with zeta potential of 30.6 mV. Antibacterial effect of PEI against *S. mutans* was significantly higher than that of MDPB in Clearfil Protect Bond; a commercial adhesive used as control ($p<0.05$). The addition of 0.2 wt% modified nano-hydroxyapatite resulted in higher values of ultimate tensile and micro-shear bond strength than other filler concentrations and commercial Clearfil S3 bond ($p<0.05$). According to this study; incorporation of 0.2 wt% QPEI-HAp nanoparticles enhanced the adhesive properties and may be promising multifunctional filler.

Biography

Randa Sabry Ibrahim has completed her PhD from Tanta University, Egypt. She is currently working as Assistant Professor in Tanta University and also the Director of Restorative and Biomaterial courses in College of Dentistry; King Saud bin Abdulaziz University for Health Sciences. She is interested in nanotechnology and biomaterials development and this is the target of her ongoing research work.

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